

The University of Chicago

**SPECIFIC OBJECTIVES AND CONTENTS OF
VOCATIONAL EDUCATION IN AGRI-
CULTURE IN THE PHILIPPINES:
RICE CULTURE**

**A PART OF A DISSERTATION SUBMITTED TO
THE FACULTY OF THE DIVISION OF THE
SOCIAL SCIENCES IN CANDIDACY FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY**

DEPARTMENT OF EDUCATION

1937

**By
CECILIO PUTONG**

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Statement of the Problem

Curriculum workers in the field of vocational education have during the last fifteen years been discovering and developing techniques to be applied in determining the content of various vocational courses. Employing the method of activity analysis they have, in general, gone out into the various vocations and listed the duties or activities which those engaged therein are actually performing. The greatest value of these efforts lies, it would seem, in the objective basis which they afford for a functional approach to the problem of curriculum construction in the field of vocational education.

Purpose of the study.--This study is an attempt to determine the extent to which scientific publications can be used as a source of materials for curriculum-making in farm crops, with special reference to rice culture. More specifically, it seeks to discover a method whereby the raw elements for a course of study in rice culture can be derived from scientific literature.

Need for the study.--So far as the present writer is aware, no attempt to discover the activities sanctioned by agricultural science for Philippine farming has ever been undertaken with a view to finding a functional basis for curriculum construction in agriculture. The course of study in farm crops used at present in the agricultural and rural high schools of this country is nothing more than a mere syllabus, with no basis that can at all be termed scientific. In the absence of research in this field, it was doubtless the best to be had. It is believed, however, that a study is needed which will furnish a basis for a scientific determination of the objectives and the contents of the curriculum in agriculture in the Philippines. This the present study attempts to do; it endeavors to list the activities recommended by specialists who have made a study of the work of farmers in order that a functional basis may be derived for curriculum-making in rice culture.

Scope of the study.--It was intended originally to limit the study to the purely productive phases of the farmer's work. Since every farmer who hopes to attain economic competence must, however, know how to market his crop on the most advantageous terms, it would seem but proper to include in his training some instruction regarding the marketing of rice. In contrast with the procedure used in other parts of the study, the activities and technical information listed under marketing were taken from theses written by graduates of the College of Business Administration of the University of the Philippines.

Why rice culture?--A study might have been made of any of the major crops of the Philippines--sugar cane, coconut, tobacco, rice, and corn. A consideration of the importance of the role played by rice in the diet of the Filipino, however, makes that the most logical crop to study. Moreover, rice is grown throughout the country. It is extensively cultivated. According to Camus, the total area planted to this cereal in the year 1920 was about the same as that planted to abaca, coconut, corn, sugar cane, and tobacco together.¹ As may be seen from the following table, rice was still the most extensively cultivated crop in 1932.

TABLE 1
AREA PLANTED TO EACH OF THE MAJOR
CROPS OF THE PHILIPPINES IN 1932*

Sugar cane	253,110	hectares
Abaca	467,040	"
Corn	577,130	"
Tobacco	78,230	"
Coconut	566,100	"
Rice	1,781,630	"

*Statistical Handbook of the Philippine Islands, 1932. Manila: Bureau of Printing, 1933.

Since machinery is not being employed in the cultivation of rice in this country to any such great extent as it is used in the cultivation of sugar cane, it would seem obvious that the number of persons engaged in the production of rice must be large. From the standpoint of vocational expectancy, therefore, as well as from that of the importance of the cereal as a food of the majority of the Filipinos, the choice of rice as the subject of

¹J. S. Camus, Rice in the Philippines, p. 13. Manila: Bureau of Printing, 1921.

this study would seem to be fully justified.

Sources of Data and Method of Procedure

Basic assumptions.--The technique employed in the present study is based on the following assumptions:

1. That we wish to train the students in our agricultural and rural high schools in the most effective methods of farming.
2. That in so far as the scientific bases of farm practice are known, they should be taught to the extent of the students' comprehension.
3. That specialists in agricultural science are competent to give advice and recommendations regarding farm practices.
4. That the field agronomists whose work it is to advise farmers on improved methods of farming are qualified to pass upon the practicality of the recommendations found in agricultural literature.
5. That in so far as existing deficiencies in farm practice can be determined, it is the function of agricultural education to correct them.

The procedure in brief.--Three steps in procedure were followed in the present study; namely:

1. Listing the activities found in agricultural literature, together with the principles, if any, illuminating each activity.
2. Submitting the list of activities to field agronomists for evaluation on the basis of practicality.
3. Submitting the evaluated list to teachers of agricultural subjects in agricultural and rural high schools, with a view to determining which of the activities are now being practiced by our farmers and which are not.

Sources of data.--Publications of experiment stations and other forms of literature dealing with rice culture and rice marketing in the tropics, particularly in the Philippines, were used. In selecting the publications to be included in the first list of possible sources, the following principles were used as control elements:

1. The publication should be relatively recent. None was used which was more than twenty-five years old. It might appear at first blush that the decision on the year of division between what should be used and what should be rejected was an arbitrary one; in so far as concerned Philippine materials, however, the

decision would seem to be justified, in view of the fact that modern experiment stations were first established only some time after the institution of American sovereignty over the Islands.

2. The authorship must be known. Some articles which apparently could have been used had to be rejected because they were anonymous. It is the belief of the present writer that publications, in order to acquire standing, ought to make their authors known. In the case of government circulars the Director of the issuing office was assumed to be the author unless some other name was given.

After applying these principles to all the literature available for use, a total of 153 publications was listed, consisting of the following:

Government bulletins	2
Government circulars	15
Books	5
Magazine articles	125
Theses	<u>6</u>
Total	153

Evaluation of sources.--With a view to obtaining a higher degree of selection than is possible with the mere application of the two principles already named as control elements, the 153 titles of publications were submitted to eight competent men with the request that they go over the entire list and check those they considered deserving of being included in the final list to be used in this study. The authorities whose opinions were sought were the following: Dr. Nemesio B. Mendiola, Professor and Head of the Department of Agronomy, College of Agriculture, University of the Philippines; Dr. Edwin B. Copeland, Technical Adviser and Botanist, Economic Garden, Los Baños; Mr. Hilarion S. Silayan, Director of the Bureau of Plant Industry; Mr. José S. Camus, Under-Secretary of Agriculture and Commerce; Dr. Francisco M. Sacay, Acting Head, Department of Agricultural Education, College of Agriculture, University of the Philippines; Mr. Francisco Octubre, Superintendent, Maligaya Experiment Station, Muñoz, Nueva Ecija; Dr. Rafael B. Espino, Professor and Head of the Department of Plant Physiology, College of Agriculture, University of the Philippines; Dr. Toribio Vibar, former Chief Agronomist, Bureau of Plant Industry.

Of the 153 original titles, ninety-eight were selected by at least three of the authorities as suitable for the purpose of this study.

Listing the activities.--The first step consisted in listing the activities. The different source materials were assigned code numbers so as to facilitate reference. Since it was thought best to begin with a publication covering the whole range of activities involved in rice growing, Camus' Rice in the Philippines was used first. Activities found in this bulletin were recorded on three- by five-inch slips of paper, one activity on each slip; whenever any technical information was given by way of explaining the activity, it was written on the same slip just below the latter. In the upper left-hand corner was entered the code number of the publication.

The following are inserted to illustrate the method of listing the activities and of recording the technical information:

19 Cover the bed with banana leaves.	19 Cover the bed with a layer of either clean rice chaff or finely chopped straw.
--	--

19 Sow the seed thickly over the bed. . . . Need of giving the young seedlings a firm stand.
--

After all the activities found in the bulletin had been carded as explained above, they were grouped under larger units according to the nature of the different activities. For example, some naturally grouped themselves under "Preparing the Land"; others under "Preparing the Seed Bed"; still others under "Transplanting"; and so on. The larger headings were written on guide cards to be placed in an ordinary card box, and activities belonging to each category were filed behind the appropriate card. The next reference was then examined for activities, and as in the case of the first, the activities as well as the principles illuminating them were recorded on slips, which were placed under the proper classification. The same procedure was followed with the remaining publications.

The next step was to combine into a single statement the different statements of the same activity. This was accomplished by framing a single statement expressing as nearly as possible the idea contained in the separate statements. The code numbers indicating the respective sources of these statements were then placed in parentheses after the composite statement so as to indicate approval of that particular activity by the specialists represented by the numbers. The following example will serve to illustrate this step:

If the plants are of full age and well developed, about one-third of the top should be cut off. (19)

. . . . cutting off about one-third of the top to check evaporation. (21)

The tops are then cut off. This limits the loss of water from the leaves while the roots are re-establishing themselves. (24)

. . . . their tops being first cut off to prevent evaporation. (37)

Top seedlings if too long. (11)

Trim if very tall. (76)

Prune back to 25 to 37 cm. long to lessen evaporation. (13)

Combined statement:

Trim the seedlings if of full age and well developed. (19)(24)(37)(11)(76)(13)

Publication No. 21 was not included because it was written by the same person as was publication No. 19.

In order to provide some sort of check on the reliability of the data secured by the technique employed in this study, a second listing of the activities found in Camus' Rice in the Philippines was made five years after the first listing. The two lists gave a correlation of .94, which is considered sufficiently high for the purpose of this investigation.

Recommended Activities and Related Knowledge

The following criteria for the selection of activities are proposed in this study: (1) experimental validation, (2) complete agreement among specialists, (3) preponderance of opinion among specialists, (4) equal division of opinion among specialists.

Below are listed the activities involved in rice culture and marketing as recommended by specialists in agriculture, together with the related knowledge regarding each activity. Before each activity a symbol has been placed to indicate the evaluation

of the activity according to the above criteria. Activities which have been experimentally validated are indicated by an asterisk (*); those on which there is complete agreement among the specialists are indicated by the symbol (&); those on which the specialists are not in complete agreement but on which there is a preponderance of opinion in favor of one view are indicated by the symbol (#); and those on which opinion is equally divided are indicated by the symbol (?).

TABLE 2

ACTIVITIES INVOLVED IN RICE CULTURE
AND RELATED KNOWLEDGE

Activities	Related Information
<u>A. Preparing the Land</u>	
&Selecting land that is suited to rice culture (19) (24) (4) (41)	...
#Select a place with a humid atmosphere (19) (37)	Climate: mean precipitation of 1,500-2,000 mm. evenly distributed throughout the growing period (15)
Moist atmosphere not essential (24)	Dry atmosphere helps absorption of water and food materials (24)
	Grain yield is highest during season of high evaporation and lowest during season of low evaporation (63) (33)
.....	
?Plow the land wet (19)(41)	Value of reducing the draft on the plow (19)
?Plow the field as dry as may be possible (24) (37) (13)	Danger of much water: lessens the action of plowing and harvesting (13)
	Renders puddling difficult (13)
	Small mouldboard drawn by bullocks or carabaos preferable to machinery (24)
.....	
*Use natural fertilizers, as barn manures, horse manure, and ashes in preference to commercial fertilizers (19) (24)	Barn manure a quicker and better source of food elements than any other known material (19) (40)
Etc.	Etc.

Interpretation and conclusions.--An examination of Table 2 will show a wide range of activities which a rice farmer is expected to perform from the beginning of the enterprise to the

marketing of his crop. It will be seen also that only an insignificant portion of these activities is supported by experimental evidence. As a matter of fact, with the exception of the activity relating to the use of fertilizers and that in connection with the correction of soil acidity, most of the activities in the above table have probably been empirically derived, while some are at best merely the opinions of the specialists who recommended them. Even so, there is no reason why they should not be used in curriculum construction if they have been found to be practical or if they give promise of being practical. Since agricultural education must go on, curriculum-making in this field cannot very well be postponed until every recommendation of our agricultural specialists shall have been scientifically validated. In the absence of clearly demonstrated truths, workable hypotheses should be used.

There seems to be good evidence that on the whole there is complete agreement among the specialists in their recommendations. Not every activity, of course, has been mentioned by every specialist; specific mention of all activities by all specialists would be too much to expect, since no list was submitted to them with a view to bringing forcibly to their attention each activity involved in rice growing and marketing. Furthermore, many of the specialists limited themselves in their studies to a rather narrow phase of the whole field of rice culture and marketing. One writer, for example, discussed the growing of lowland rice alone; another, of upland rice alone; one studied the subject of weeds and their control, while another discussed rice pests, and so on. Consequently a fairly large number of activities--113 out of a total of 293--were mentioned by only one specialist. The remaining 180, constituting 61.4 per cent of the whole, were recommended unanimously by from two to ten specialists. This complete agreement would seem to strengthen confidence in the soundness of the recommendations.

Returning to the activities recommended by only one specialist, question might be raised as to the advisability of using them in curriculum-making. If the recommendations were made by an ordinary layman they might not deserve any consideration, but in the present case they were made by specialists who had spent years of study and observation in this small area of occupational activity. Further, the technique employed in this study provides what is believed to be an adequate safeguard against consideration

for curriculum-making in the case of any proposal or recommendation likely to bring failure to the farmer. This safeguard is to be found in the submission of the activities to the field agronomists and experiment station superintendents of the Bureau of Plant Industry.

Table 2 also shows that in the case of six activities not recommended unanimously by the specialists, there was a preponderance of opinion in favor of one activity or the other. Under the circumstances, and until the activities shall have been experimentally validated, it would seem reasonable to accept tentatively the pronouncements of the larger number and at the same time to bear in mind the recommendation of the minority.

Opinion was divided on one activity; namely, whether the land should be plowed wet, as recommended by three specialists, or whether it should be plowed as dry as possible, as recommended by a like number. It has been held that in this case both recommendations should be considered for classroom discussion.

It is interesting to note the mass of informational material in the form of facts and principles gathered from the different publications. This related knowledge should be of immense value to the curriculum-maker who realizes that the training of a farmer should not be limited to the purely manipulative activities and skills but should extend to the pertinent facts, principles, and generalizations that will give meaning to each activity. The former type of training is likely to produce automatons, while the latter will make for intelligent, self-respecting farmers.

The discussion of the data presented in Table 2 seems to point to the following conclusions:

1. That the writings of specialists in agriculture contain a rather large number of activities calculated to help the rice farmer in his work.

2. That although only a few of these recommended activities are supported by experimental evidence, all of them constitute the very best knowledge available at present on this particular area of agriculture.

3. That on the whole there is almost perfect agreement among the specialists in regard to the desirability of the different activities.

4. That where they differ in opinion, there is usually a preponderance in favor of one recommendation or the other.

5. That a great deal of related knowledge is available in

the writings of specialists, its inclusion in such writings making the recommended activities intelligible to the reader.

Evaluation of Activities on the Basis of Practicality

The next step in the procedure followed in this investigation was to have the activities evaluated on the basis of practicality. The problem was to determine which of the recommended activities listed in Table 2 are practical under actual farm conditions and which are not.

It was believed advisable to apply the criterion of practicality to these activities for the reason that it sometimes happens that recommendations of specialists do not prove effective under actual farm conditions, either because they have not been sufficiently verified by field tests or because factors which were not operative at the time and place of the experiment are operating in the new situation. Furthermore, since many of the recommendations are still on the level of hypothesis, a statement regarding their effectiveness would be helpful to the curriculum-maker. For these reasons the following procedure was adopted:

The activities were put in the form of a questionnaire, which was submitted to twenty-one judges--two superintendents of experiment stations who have done considerable work on rice, and nineteen field agronomists stationed in different parts of the country--with the request that they indicate by check marks (✓) the activities which they have found to be practical and which they would therefore recommend to be taught to our students, and by crosses (x) those activities they would not so recommend.

Eighteen returns were received. Considering the task these men were asked to perform, it would seem that they would be fully competent to make the evaluation. However, in order to be doubly certain that the evaluation would have behind it not only practical experience but also adequate technical training, it was thought best to use only those returns received from the men with college training in agriculture. There were thirteen such returns, and the result of their evaluation is given in Table 3, to be found on the following page together with Table 4.

Interpretation and conclusions.--An examination of Tables 3 and 4, particularly of Table 4, reveals a number of interesting facts. In the first place it appears that, on the whole, the

TABLE 3

THE ACTIVITIES EVALUATED ON THE BASIS OF PRACTICALITY*

No.	Activity	Evaluation as to Practicality	
		Yes	No
1.	Select land that can be provided with an adequate supply of water.....	13	0
2.	Select land that can be effectively drained	13	0
3.	Select level land	12	1
4.	Etc.		

*Read table thus: Activity No. 1 is considered practical by the thirteen field agronomists and station superintendents whose opinions were sought on the matter; etc.

TABLE 4

ACTIVITIES CONSIDERED IMPRACTICAL BY A MAJORITY OF THE THIRTEEN MEN OF THE BUREAU OF PLANT INDUSTRY

No.	Activity
6.	Select a place with a humid atmosphere
7.	Avoid soils rich in nitrogen (lowland rice)
16.	Plow the field as dry as may be possible
24.	Allow the land to stand ten days again before transplanting
69.	Avoid soils rich in nitrogen (upland rice)
81.	Germinate the seed previously (in upland rice culture)
90.	Hold the water continually on the paddies
117.	Kill mayas by the use of poison
130.	Draw ropes saturated with sticky resins or creolin over the field so as to brush against the heads of the rice
227.	Have the harvesting done on a cash basis
251.	Avoid growing two crops in one year

field agronomists and station superintendents who were requested to evaluate the recommended activities endorsed them as practical under actual farm conditions. Practically 50.4 per cent of the total number of activities were pronounced practical by all thirteen judges. These facts would seem to indicate a high degree of validity of the scientific publications as sources of materials for curriculum-making. Another 45.9 per cent were pronounced

practical by most of the judges, thus giving a total of 96.3 per cent. The activities pronounced impractical by most of the judges constituted only 3.7 per cent, and--what is rather significant--not a single recommended activity was pronounced impractical by all thirteen judges.

In examining the activities listed in Table 4, it is interesting to note that two of them are among those recommendations over which there was some difference of opinion among the specialists who wrote the sources which were used. It is also worthy of note that with the exception of one activity, the preponderance of those considering these activities impractical over those voting otherwise was by no means heavy. This fact would seem to indicate that probably consideration of local conditions and local needs was responsible, at least partly, for the respective positions taken by the different judges.

The following conclusions appear to be justified by the data gathered from the evaluation:

1. On the whole, the activities recommended by the specialists as desirable were considered practical by the field men of the Bureau of Plant Industry. These activities comprise 96.3 per cent of the total number of activities.
2. Only an insignificant number of recommended activities, or 3.7 per cent of the total number, were considered impractical by the judges.

Evaluation According to General Practice

The final step in the procedure was first, to determine which of the activities recommended by the agricultural specialists and pronounced practical by field agronomists are now being practiced generally by Filipino farmers and which are not, and second, to discover the reasons for the failure of farmers to put some of the recommendations into practice.

The procedure consisted in submitting the list of activities to teachers of agricultural and rural high schools with the request that the desired information be furnished. The activities deemed impractical by the majority of the agronomists of the Bureau of Plant Industry were crossed out of the list. In cases of activities which are not being practiced, the teachers were asked to indicate the reason therefor. Three possible reasons were suggested in the questionnaire, the teachers being requested to indi-

cate by a check mark (✓) the one applying to the particular activity under consideration. These possible reasons are as follows:

(a) Farmers have never known or heard of the recommended activity. Methods of farming in the Philippines being more or less primitive, it is more likely than not that the average farmer is not aware of this or that activity. It should therefore be made known through teaching.

(b) Farmers have tried the recommended activity but have found that it does not pay to follow it. There may be some activities which have been recommended by specialists but which for one reason or another have not been found advisable from the business point of view. Such activities should be taught, but with reservations. The fact that they have not been found profitable in practice should be pointed out.

(a) Farmers know about the recommended activity but they are unable to break away from tradition, and so instead of following the recommendation of specialists, they merely observe the practices of their forefathers. Very often farmers listen to a lecture on improved methods of farming and appear to be convinced of the desirability of the methods recommended by the lecturer, but when they return to their farms they do nothing to carry out the recommendation; they simply continue to follow the traditional practice. In such cases the teacher must do two things: first, he has to break through the crust of tradition, and second, he must teach the recommended activity to the level of actual performance.

Activities which according to the teachers are now being practiced by the farmers should also be taught, although not so much time, relatively speaking, will need to be spent on them as on the other groups.

The response of the teachers was quite good. Of the twenty-five schools asked to co-operate, twenty-two, or 88 per cent, returned the questionnaire properly filled out. The results of the evaluation are given in Tables 5 to 8 on the following pages.

Interpretations and conclusions.--An attempt will be made to answer the questions which were raised in connection with the evaluation of the activities by teachers of agriculture. The first question was, which of the recommended activities are now being put into practice by our farmers? Table 6 gives a list of these. According to this table they number one hundred ten, constituting only 40.9 per cent, or considerably less than one-half

TABLE 5

ACTIVITIES EVALUATED ON THE BASIS OF PRACTICE
BY FILIPINO FARMERS

No.	Activity	Yes	No		
			(a)	(b)	(c)
	<u>A. Preparing the Land</u>				
1.	Select land that can be provided with an adequate and constant supply of water	23	0	0	0
2.	Select land that can be effectively drained	19	1	0	1
3.	Select level land	23	0	0	0
4.	Select fairly shallow and fertile soil	16	4	0	3
5.	Select heavy clay soil underlaid by an impervious subsoil	19	0	1	3
	Etc.				

*This table should be read thus: Activity No. 1 is now being practiced generally by our farmers in all the regions served by our agricultural schools; etc.

TABLE 6

ACTIVITIES ALREADY BEING PRACTICED GENERALLY
BY FILIPINO FARMERS

No.	Activity
	<u>A. Preparing the Land</u>
	(New Land)
1. . .	Select land that can be provided with an adequate and constant supply of water
2. . .	Select land that can be effectively drained
3. . .	Select level land
4. . .	Select fairly shallow and fertile soil
5. . .	Select heavy clay soil underlaid by an impervious subsoil
6. . .	Burn the brush during the dry season and remove all stumps and grass roots
7. . .	Plow the land when the rains commence
8. . .	Etc.

TABLE 7

ACTIVITIES WHICH ARE NOT BEING PRACTICED, EITHER BECAUSE
OUR FARMERS ARE NOT AWARE OF THEIR ADVANTAGES OR
BECAUSE THEY ARE STILL DOMINATED BY TRADITION

No.	Activity
18. . .	Do the first plowing at the same time the seed bed is sown
20. . .	Plow deeper every third or fourth year in the case of old rice land having a rich compact subsoil
22. . .	Plow twice with an interval of 10 to 15 days
26. . .	Use natural fertilizers, such as barn manures, horse manures, and ashes
27. . .	Apply commercial fertilizers to poor land
28. . .	Apply the fertilizers to the field 10 to 15 days after planting
29. . .	Have local tests made in order to determine the requirements of any given soil
30. . .	Add nitrogen in the form of green manures
Etc.	

TABLE 8

ACTIVITIES WHICH OUR FARMERS HAVE FOUND NOT ADVISABLE
TO FOLLOW, ACCORDING TO THREE OR MORE TEACHERS

No.	Activity
	<u>A. Preparing the Land</u>
17. . .	Incorporate weeds and straw into the soil
18. . .	Do the first plowing at the same time the seed bed is sown
26. . .	Use natural fertilizers, such as barn manures, horse manures, and ashes
27. . .	Apply commercial fertilizers to poor land
Etc.	

of the whole list. It would seem, therefore, that the chances are not high that our students have had first-hand knowledge of these activities--much less, actual experience in them. In other words, the chances are more than even that the students in our agricultural and rural high schools will come to know of these activities for the first time in their lives only when they enter upon the study of agriculture. If such be the case, our teachers of agriculture will have to exert plenty of effort in order to put the students in a position of complete mastery of the various abilities

and skills involved in the growing and marketing of rice.

An examination of those activities that are generally being practiced seems to reveal the interesting fact that they are the minimum needed in order to produce a rice crop. It would appear that our farmers in the Philippines are practicing only those activities needed in raising a rice crop with marginal efficiency, a finding that would seem to have important implications both for the curriculum-maker and for the teacher of agriculture. If the rice-growing industry is to improve it is essential that new skills and abilities considered important by those in a position to know be tried out, and if found practicable and profitable, be added to the training of future farmers. These new skills and abilities are listed in Table 7.

The second question asks the reasons for the failure of Filipino farmers to put the recommended activities into practice. One hundred sixty-nine of these activities, or 59.1 per cent of the whole list, are not as yet being practiced; the reasons for the failure are shown in Table 5. In the case of one hundred thirty-nine activities the failure is apparently due to the farmers' unawareness of their advantages, but in the case of thirty the reason is found in the dominance of tradition.

It seems significant indeed to note that the activities not being practiced by Filipino farmers are largely of the type which may be characterized as the refinements of rice culture. They are activities which involve the use of fertilizers, the selection of seed, the testing of seed, the use of the dapog method of preparing the seed bed, the drilling in of the seed in upland rice culture, the control of pests and diseases, modern methods of threshing and cleaning of rice, crop rotation, crop diversification, farm accounting, and marketing--activities all which if properly carried out will make not only for an increase in the yield and an improvement in the quality of the crop, but also for an increase in the profits. It is obvious that these activities should be taught and emphasized, in order that the level of performance may be raised. The influence of tradition must be overcome. If farmers the world over are reputed to be a conservative group, those in the Philippines must be characterized as ultra-conservative; the curriculum in agricultural schools of the Islands must therefore assume an aggressive attitude and make a determined move toward progress in the rice-growing industry.

No activity was considered entirely unprofitable from a business standpoint by a preponderant portion of the farmers, in the observation of the teachers reporting, but according to reports received from three or more schools a number of activities were found to fall under that category. These are listed in Table 8. In the case of these activities it would seem advisable to proceed with circumspection. Judging from the fact that some practical farmers have found them not profitable, as reported by teachers from three or more schools, it appears that teachers of rice culture cannot be very positive in their teaching of these activities, but should teach them as activities found profitable in some places but not in others. It would be highly desirable to have these activities tried out on the school farm for purposes of verification.

The data resulting from this evaluation seem to justify the following conclusions:

1. That on the whole the rice farmers of the Philippines are not doing as they ought in order to attain maximum efficiency in their work. Of the 279 activities recommended by specialists and considered practical by field agronomists, only fewer than one-half are being put into practice.
2. That the most important reason for this failure to put the recommendations into practice is the farmers' unawareness of the advantages to be derived from them.
3. That the influence of tradition appears to have a strong hold on the farmers, keeping them from carrying out some of the recommendations of the specialists.
4. That although none of the recommended activities was considered inadvisable from the business point of view by farmers, as reported by the majority of the teachers who evaluated them, a number of such activities are so considered in three or more places.

General Summary and Conclusions

This investigation was undertaken for the purpose of determining the extent to which scientific publications can be used as a basis for curriculum construction in agricultural subjects. Since the main contribution of this study was intended to be the development of a technique which might be employed in curriculum construction in agriculture when using scientific publi-

cations as sources of materials, it was thought best to limit the study to the growing and marketing of rice. It was felt that once the technique should be developed, its application to the other crops would be a relatively simple matter.

The basic philosophy underlying the whole investigation is that the objectives and the content of the curriculum in any area of occupational activity should be the best obtainable in the present stage of scientific development attained in that area. Not what the people engaged in the vocation are actually doing now, but what science says these people ought to do, should be the principal criterion in the selection of curriculum materials. Consequently, a bibliography of 153 titles, all dealing with one or more aspects of rice culture and rice marketing, was collected. Of this number, ninety-eight were selected by at least three thoroughly competent judges as appropriate for the purpose of this study.

As a first step, every one of the ninety-eight publications was canvassed for activities and related knowledge. Identical statements found in the different publications were combined into one statement, with the result that in the end a list was obtained of activities marked by certain conventional signs to indicate: (1) that the recommended activity was the result of scientific experimentation; (2) that the activity was recommended unanimously by the specialists; (3) that although disagreement regarding the activity existed among the specialists, a preponderant number of them recommended it; and (4) that expert opinion was equally divided on the question of the soundness of the recommendation. This list, together with the related knowledge, is given in Table 2.

The next step was to submit the list of activities to field agronomists and experiment station superintendents of the Bureau of Plant Industry for evaluation on the basis of practicality, it being thought that recommendations, in order to have curricular value in the field of agriculture, must be practical under actual farm conditions. What would it profit a farmer to run his farm on a strictly scientific basis if as a result he should suffer financial loss and possibly face bankruptcy? There is no doubt, for instance, that an immaculately clean farm is an ideal to strive for, but it is equally certain that in this matter of cleanliness a point is eventually reached beyond which the law of diminishing returns begins to operate, so that any additional amount spent in

weeding would be accompanied by a proportionately smaller profit and finally even by actual loss. The data bearing on this evaluation by the field agronomists and experiment station superintendents are presented in Table 3.

Finally, the activities as evaluated by the Bureau of Plant Industry field men were submitted to teachers of agricultural subjects in our agricultural and rural high schools in different sections of the country, for evaluation on the basis of general practice. The desire was to find out whether the recommended practices were now being actually followed by our farmers, and in cases where the recommended activities were not being practiced, to learn the reasons for the farmers' failure to practice them. The data bearing on this evaluation are presented in Tables 5 to 8.

The data gathered in this investigation appear to justify the assumption stated previously that specialists in agricultural science are competent to recommend what our farmers ought to do in order to attain maximum efficiency in their work. It was pointed out in a preceding paragraph that practically all the activities recommended by the specialists--96.3 per cent, to be more exact--were pronounced practical by the field agronomists who evaluated them. Even in the case of the remaining 3.7 per cent considered impractical, not one activity was so considered unanimously by the judges. Add to this the further fact revealed in Table 5 that no activity has been reported by a large number of teachers of agriculture as unprofitable from the business standpoint, and one is almost driven to the conclusion that on the whole the pronouncements of agricultural specialists can be relied upon as sound.

If these interpretations of the data be sound, it would seem that there is every justification for teaching the activities and related knowledge gathered in this investigation to the students who expect to engage in rice farming. Considerations of economy of time and effort, however, demand that the weak points in the vocation be discovered, in order that emphasis may be placed where it is needed. In certain cases education may be said to have a residual function; that is, the school should take care particularly of those essential activities which the students have not learned through actual experience as they assist in the work of the farm before attending the agricultural school. Taking the cue from the field of general education, the educator knows that by the time a child is ready to enter school he has already learned

will find very useful the activities which are listed in Tables 5 to 8, together with the related knowledge given or indicated in Table 2. The related knowledge given in Table 2 will provide a basis for determining what items of subject matter should go into the theoretical part of the course of study, while the recommended activities will serve to indicate the nature of the practical work which the students ought to perform as part of their training. When the course is completed, it should be tried out experimentally in a number of selected agricultural and rural high schools in order to determine its effectiveness and to discover whatever defects and imperfections it may have, after which it should be revised and issued to all schools offering instruction in rice growing.

It would be well also to apply the technique herein described in the discovery of materials and in the development of courses of study to the other areas of agricultural activity--sugar cane, tobacco, corn, and coconuts--and later to the various minor crops commonly raised in this country. In this way the different agricultural and rural high schools will in time be provided with a curriculum in agriculture which has been worked out on a scientific basis.

